CLAIMS

What is claimed is:

1. An apparatus for characterizing optical properties of a sample, comprising:

a) a light source for generating a broadband beam;

b) at least a first set of components defining a first light path, said components including at least a first component pair of a planar mirror and a parabolic mirror with a first focal length and a second component pair of a planar mirror and a parabolic mirror with a second focal length, wherein said broadband beam illuminates said planar mirror and said parabolic mirror in said first component pair and said planar mirror and said parabolic mirror in said second component pair at angles substantially near normal to said planar mirror and said parabolic mirror in said first component pair and said planar mirror and said parabolic mirror in said second component pair; and

c) an element onto which said broadband beam is illuminated, wherein said broadband beam illuminates said element at angles substantially near normal to said element.

2. The apparatus of claim 1 wherein said planar mirror and said parabolic mirror in said first component pair are positioned such that said broadband beam exiting said first component pair is collimated.

3. The apparatus of claim 1 wherein said planar mirror and said parabolic mirror in said second component pair are positioned such that said broadband beam entering said second component pair is collimated.

4. The apparatus of claim 1 wherein said planar mirror and said parabolic mirror in said first component pair each has a UV-enhancing aluminum coating.

5. The apparatus of claim 1 wherein said planar mirror and said parabolic mirror in said second component pair each has a UV-enhancing aluminum coating.

6. The apparatus of claim 1 wherein said first focal length of said parabolic mirror in said first component pair is different than said second focal length of said parabolic mirror in said second component pair.

7. The apparatus of claim 1 wherein said first set of components further comprises a polarizing means.

8. The apparatus of claim 7 wherein said polarizing means polarizes said broadband beam in one of two orthogonal directions.

9. The apparatus of claim 7 wherein said polarizing means further comprises a rotatable polarization analyzer.

10. The apparatus of claim 1 wherein said element is selected from the group consisting of a sample and a first detector.

11. The apparatus of claim 10 further comprising a polarizing means in said first detector.

12. The apparatus of claim 11 wherein said polarizing means further comprises a rotatable polarization analyzer.

13. The apparatus of claim 10 wherein said first detector is a spectroscopic ellipsometer.

14. The apparatus of claim 1 wherein said broadband beam has wavelengths lying in a range between 190 and 1100 nm.

15. The apparatus of claim 1 wherein said broadband beam has a diameter of greater than 500 μm at said light source and a diameter lying in a range between 50 and 80 μm when illuminated onto a top surface of said sample.

16. The apparatus of claim 1 further comprising a means of mechanically displacing said second component pair while maintaining relative position of said parabolic mirror and said planar mirror such that distance from

said parabolic mirror and a top surface of said sample is such that said broadband beam is focused.

17. The apparatus of claim 1 further comprising a second set of components defining a second light path, wherein said element is a first detector.

18. The apparatus of claim 1 further comprising a third set of components defining a third light path.

19. The apparatus of claim 18 wherein said first focal length of said parabolic mirror in said first component pair in said third light path and said second focal length of said parabolic mirror in said second component pair in said third light path are different than said first focal length of said parabolic mirror in said first component pair in said first light path and said second focal length of said parabolic mirror in said second component pair in said first light path.

20. The apparatus of claim 18 wherein said element is a first detector.

21. The apparatus of claim 18 wherein said element is a second detector.

22. The apparatus of claim 21 further comprising a polarizing means in said second detector.

23. The apparatus of claim 22 wherein said polarizing means further comprises a rotatable polarization analyzer.

24. The apparatus of claim 21 wherein said second detector is a spectroscopic ellipsometer.

25. The apparatus of claim 18 further comprising a fiber for redirecting said broadband beam.

26. A method of characterizing optical properties of a sample comprising the steps of:

a) providing a sample to be characterized;

b) generating light in a broadband beam;

c) magnifying and illuminating said broadband beam onto a top surface of said sample in a first set of reflective components defining a first light path, wherein changes in polarization of said broadband beam are minimized by ensuring that said broadband beam illuminates said reflective components in said first light path and said sample at angles substantially near normal to said reflective components and said sample;

d) magnifying and illuminating said broadband beam reflected from said top surface of said sample to a first detector in a second set of reflective components defining a second light path, wherein

changes in polarization of said broadband beam are minimized by ensuring that said broadband beam illuminates said reflective components in said second light path and said sample at angles substantially near normal to said reflective components and said sample;

e) measuring an intensity of said broadband beam reflected from said top surface of said sample with said first detector; and

f) determining optical properties of said sample based on said intensity of said broadband beam reflected from said top surface of said sample.

27. The method of claim 26 further comprising the step of polarizing said broadband beam in said first light path in one of two orthogonal directions.

28. The method of claim 26 further comprising the step of focusing said broadband beam illuminating said top surface of said sample in said first light path.

29. The method of claim 26 further comprising the step of focusing said broadband beam reflected from said top surface of said sample in said second light path.

30. The method of claim 26 further comprising the step of adjusting polarization of said broadband beam reflected from said top surface of said sample in said second light path.

31. The method of claim 26 wherein said broadband beam has wavelengths lying in a range between 190 and 1100 nm.

32. The method of claim 26 further comprising the steps:

h) magnifying and illuminating said broadband beam from a bottom surface of said sample, after transmission of said broadband beam from said top surface of said sample through said sample, to a second detector in a third set of reflective components defining a third light path, wherein changes in polarization of said broadband beam are minimized by ensuring that said broadband beam illuminates said reflective components in said third light path and said sample at angles substantially near normal to said reflective components and said sample;

i) measuring an intensity of said broadband beam from said bottom surface of said sample, after transmission of said broadband beam from said top surface of said sample through said sample, with said second detector; and

j) determining optical properties of said sample based on said intensity of said broadband beam from said bottom surface of said sample, after transmission of said broadband beam from said top surface of said sample through said sample.

33. The method of claim 26 further comprising the steps:

h) magnifying and illuminating said broadband beam from a bottom surface of said sample, after transmission of said broadband beam from said top surface of said sample through said sample, to said first detector in a third set of reflective components defining a third light path, wherein changes in polarization of said broadband beam are minimized by ensuring that said broadband beam illuminates said reflective components in said third light path and said sample at angles substantially near normal to said reflective components and said sample;

i) measuring an intensity of said broadband beam from said bottom surface of said sample, after transmission of said broadband beam from said top surface of said sample through said sample, with said first detector; and

j) determining optical properties of said sample based on said intensity of said broadband beam from said bottom surface of said sample, after transmission of said broadband beam from said top surface of said sample through said sample.

34. The method of claim 26 further comprising the step of focusing said broadband beam from said bottom surface of said sample in said third light path, after transmission of said broadband beam from said top surface of said sample through said sample.